

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
SPECIFICATION FOR
PUMP, ENGINE-DRIVEN

1. SCOPE.

1.1. Scope. The engine-driven pumps described in this specification are designed for use in wildland firefighting operations. The pumps consist of a gasoline-driven engine, a positive displacement or centrifugal type pump, mounting frame, engine controls, spark arrester, priming system and other components. The thread series designations for the inlet and outlet connections are 1 inch 11-1/2 NPSH, 1-1/2 inch 9 NH and 2-1/2 inch 7-1/2 NH.

2. APPLICABLE DOCUMENTS.

2.1. Government Documents. The following specifications, standards, and handbooks form a part of this document to the extent specified herein. Unless otherwise specified, the issue of these documents are those in effect on the date of the invitation for bids or request for proposals (See 6.2).

USDA Forest Service Standard

5100-01 - Spark Arresters for Internal Combustion Engines

5100-107 - Fire Hose Connections and Fittings

5100-190 - Threads, Gaskets, Rocker Lugs, Connections and Fittings, Fire Hose

Federal Standard

FED-STD-595 - Colors

U. S. Department of Labor

Federal Register Volume 37, Number 202, Part II - Occupational Safety and Health
Administration, Safety and Health Regulations for Construction.

Beneficial comments, recommendations, additions, deletions and any pertinent data that may be used in improving this document should be addressed to: USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198 by using the Specification Comment Sheet at the end of this document or by letter.

Copies of federal standards and test methods are available from General Services Administration, Federal Supply Service Bureau, Specification Section, Suite 200, 470 East L'Enfant Plaza SW, Washington DC 20407.

Copies of USDA Forest Service Specifications and Standards are available from USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198.

2.2. Non-Government Publications. The following documents form a part of this document to the extent specified herein. Unless otherwise specified, the issues of these documents are those in effect on the date of the invitation for bids or request for proposals.

Society of Automotive Engineers (SAE)

J 512 - Automotive Tube Fittings

J 1349 - Engine Power Test Code, Spark Ignition and Compression Ignition - Net Power Rating

Address requests for copies to the Society of Automotive Engineers, 400 Commonwealth Drive, Warrendale, PA 15096.

American National Standards Institute (ANSI) / American Society for Quality Control (ASQC)

S 1.4 - General Purpose Sound Level Meters

Z 1.4 - Sampling Procedures and Tables for Inspection by Attributes

Address requests for copies to the American National Standards Institute Inc., 11 West 42nd Street, New York, NY 10036.

American Society for Testing and Materials (ASTM)

E 380 - Practice for Use of the International System of Units

Address requests for copies to American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

2.3. Order of Precedence. In the event of conflict between the text of this document and the references cited herein, the text of this document takes precedence. Nothing in this document, however, supersedes applicable laws and regulations unless a specific exemption has been obtained.

3. REQUIREMENTS.

3.1. Qualified Products List Number. The bidder shall possess a currently valid notice of qualification with associated Qualified Products List (QPL) number obtained in accordance with 4.1. The date of issue on the QPL number shall precede the date on the invitation for bids.

3.2. Construction. The term pump or pump unit, when used hereafter, shall refer to a pump and engine combination.

3.2.1. Engine. The engine shall be gasoline-powered, air-cooled, with a magneto-type or electronic ignition system. Spark plugs shall be provided with protective caps. The engine shall be capable of burning unleaded or regular grade gasoline and operating with standard lubricating oils as recommended by the engine manufacturer.

3.2.1.1. Engine Controls. Suitable controls for engine throttle, choke, ignition, and starting shall be provided. The engine shall be fitted with a positive speed control governor such that if the load on the engine should decrease suddenly, the engine shall be prevented from over-speeding.

3.2.1.2. Spark Arrester Exhaust System. A spark arrester exhaust system shall be furnished. The spark arrester shall be qualified in accordance with USDA Forest Service Standard 5100-01.

3.2.1.3. Fuel System. A fuel system with a fuel tank shall be included with the engine. The fuel tank shall be integrally mounted with a gravity feed fuel system. The fuel tank shall be provided with fuel lines, fittings, and a fuel filter. If the pump weighs over 45 lb (20.4 kg), a three-way cock shall be provided for connection to an auxiliary fuel tank. Pumps weighing more than 200 lb (90.8 kg) shall be furnished with a fuel pump. Connections and fittings for the auxiliary fuel system shall be 1/4 inch (6.35 mm) inside diameter conforming to SAE J 512 automotive flare type. The fuel cap shall be located in an easily accessible area with the filler neck positioned away from the exhaust system.

3.2.1.4. Carburetor. If a carburetor is used, it shall be equipped with an external control for adjusting the fuel to air ratio and shall include a dry or wet type air filter. The inlet to the air filter shall be positioned to prevent water or burning debris from entering the air filter intake.

3.2.1.5. Starter System. A manual crank starter, manual rope starter or 12 VDC electric starter system shall be furnished. If a manual crank starter is provided, it shall be designed to be removed and a rope starter used, when applicable. A suitable guard shall be provided around any exposed drive belts or chains. Generator equipment shall be included only as an integral part of a starter-generator combination. The electrical system shall be moisture and weather proofed.

3.2.1.6. Engine Lubrication. The lubrication system shall be adequate to lubricate the engine for a minimum of eight hours of continuous operation without servicing.

3.2.2. Pump. The pump shall be centrifugal or positive displacement type with components as indicated below.

3.2.2.1. Pump Connections and Fittings. The pump inlet and outlet shall be externally threaded with a 1-inch 11-1/2 NPSH, 1-1/2 inch 9 NH or 2-1/2 inch 7-1/2 NH thread series designation. Hose caps with rocker lugs, described in Forest Service Specification 5100-107, shall be furnished and installed on the pump inlet and outlet connections. They shall be adequately secured to the pump with minimum No. 12 single jacket brass chains or other type chain of equal strength and flexibility to prevent loss of the caps. Threads and rocker lugs shall be in accordance with USDA Forest Service Standard 5100-190. Drain plugs shall be provided on centrifugal pumps that have an inlet and outlet above the centerline of the pump.

3.2.2.2. Seal or Packing Gland. A mechanical shaft seal or pump packing gland and packing shall be provided in order to prevent leakage. It shall be able to endure a minimum 100 hours of operation with no leakage.

3.2.2.3. Pump Lubrication. A system of lubrication shall be provided and be sufficient to properly lubricate the pump for a minimum eight hours of continuous operation. The engine oil fill pipe shall be readily accessible and easily serviced.

3.2.2.4. Pressure Gage. The pump shall be equipped with a pressure gage with a range of at least 0 to 200 percent of the pump maximum rated pressure. Gage graduation shall be in divisions of not more than 25 psig (172 kPag).

3.2.2.5. Pressure Relief For Positive Displacement Pumps. If the pump is a positive displacement pump, a method shall be provided for controlling pressure either through an automatic relief valve or a pressure regulator controlling the speed of the pump. The device shall be capable of operating over a range of 90 to 300 psig (621 to 2069 kPag) discharge pressure. See 3.10.3.1.

3.2.3. Frame and Carrying Handles. The pump unit framework shall include carrying handles. Carrying provisions for one person shall be included for pump weight classes up to 80 lb (36.3 kg); two persons in single file for pump weight classes up to 130 lb (59.0 kg); and four persons double file for pump weight classes above 130 lb (59.0 kg). Handles shall be detachable or collapsible and provided with position locking mechanisms.

3.2.4. Accessories. If special tools such as a packing gland wrench and grease gun are required, they shall be supplied with the pump unit. A starter crank or rope shall be furnished with the pump unit as applicable. A metric tool kit shall be supplied by the manufacturer, if metric fasteners are used.

3.3. Material. Where more than one type of material is used in various components, there shall be no incompatibility between materials which may cause corrosion. All pump materials including fittings and adapters shall be of a material appropriate for an air-water atmosphere.

3.3.1. Paint. Exposed surfaces of the pump unit to be painted, shall be thoroughly cleaned of grease and other foreign material with a high quality surface preparation reducer. Pump exposed surfaces not to be painted are the heated exhaust parts, plastic, glass, rubber, chrome, and brass surfaces. Bare metal parts shall be coated with at least two coats of a high quality primer. Exposed galvanized surfaces shall be thoroughly washed with a surface etching solution then primed with a suitable galvanizing primer. Finish coating shall consist of two coats of top quality commercial gloss enamel red (color 11105) or green (color 14260), which shall match the corresponding color chip of Federal Standard 595. Painting shall be accomplished by spraying wherever practical. There shall be no runs, inadequate coverage, peeling, flaking, bubbling, or other defects causing inferior coatings.

3.3.2. Recoverable Materials. The contractor is encouraged to use recovered materials to the maximum extent practicable, in accordance with paragraph 23.403 of the Federal Acquisition Regulation (FAR), provided all performance requirements of this specification are met.

3.4. Weights.

3.4.1. Pump Unit. Prior to performance testing, the dry weight shall be measured and the weight class number shall be determined. See 3.10.3.9. The pump unit shall be weighed as assembled with all component parts except fuel and water. An engine driven pump unit may not exceed 400 lbs (181.4 kg).

3.5. Workmanship. Workmanship shall be equal to the best commercial practices consistent with the highest engineering standards in the industry and shall be free from any defect which may impair serviceability or detract from the product's appearance.

3.5.1. Symmetry. All metal part sections shall be symmetrical and concentric to 0.030 inch (0.762 mm).

3.5.2. Extruded Components. Extruded sections shall be free from laps, sharp die marks, cracks and other defects.

3.5.3. Cast Components. Cast parts shall be fine-grained, free from blowholes, pinholes, pits, porosity, hard spots, shrinkage, cracks or other defects.

3.5.4. Welding. All welds to include welds on the pump frame shall be thoroughly fused together with strength equal to or stronger than the adjacent material. All excess welds and splatters shall be cleaned.

3.5.5. Holes. Punched holes shall be used in lieu of drilled holes only when the punched holes are dimensionally equivalent to drilled holes. In addition, the material shall not become distorted from the punching process.

3.6. Threads, Waterways, Gaskets, Gasket Recesses and Rocker Lugs. All threads, waterways, gaskets, gasket recesses and rocker lugs shall be in accordance with USDA Forest Service Standard 5100-190.

3.7. Surface Treatment. Aluminum alloy threaded surfaces shall be hard-coated in accordance with USDA Forest Service Standard 5100-190.

3.8. Marking. Markings shall be in accordance with USDA Forest Service Standard 5100-190. In addition, a durable decal or corrosion resistant metal nameplate shall be permanently attached to the pump. The decal or nameplate markings shall include the model, name or trademark, and address of the manufacturer.

3.9. Surface Finish. The finish for all coupling surfaces, to include threaded surfaces, shall be in accordance with USDA Forest Service Standard 5100-190.

3.10. Performance.

3.10.1. Calibration of Equipment. In accordance with 4.7.2.1, before performance testing begins, the pump pressure gage and all test equipment shall be calibrated.

3.10.2. Engine.

3.10.2.1. Over-speed Control. When tested in accordance with 4.7.3.1, the engine shall not over-speed.

3.10.2.2. Governor Speed Range. When tested in accordance with 4.7.3.2, the governor speed range shall be the difference between full and minimum throttle.

3.10.3. Pump Tests.

3.10.3.1. Pressure Relief. When tested in accordance with 4.7.4.2, the discharge pressure shall not increase more than 30 psig (207 kPag) from its pressure relief setting.

3.10.3.2. Priming. When tested in accordance with 4.7.2.2, the pump priming system shall be capable of pulling 17 inches Hg (58 kPa) vacuum and establish prime and pump water in 30 seconds with a 10 foot (3.0 m) lift. In addition, the priming system shall be capable of priming and pumping water at a 17 foot (5.1 m) lift.

3.10.3.3. Drafting. When tested in accordance with 4.7.2.3, the pump shall be able to continue drafting at free flow with a minimum 17 inches Hg (58 kPa) vacuum at 3000 ft (914 m) density altitude, after establishing initial prime.

3.10.3.4. Pre-endurance Maximum Performance. When tested in accordance with 4.7.4.3, the pre-endurance maximum performance curve shall be plotted. Each of the points on this curve shall be corrected to standard sea-level. Using these corrected points, a second curve shall be plotted. From this corrected curve, the maximum pump power, p_1f_1 , shall be established.

3.10.3.5. 100-Hour Endurance Performance. When tested in accordance with 4.7.4.4, the pump performance rating, p_2f_2 , shall be determined by establishing a curve at 85 percent of the corrected curve. The pump performance rating, p_2f_2 , shall be the pressure and flow rate at which the 100-hour endurance test is run.

3.10.3.6. Pressure Gage Calibration Check at 25, 50, 75 and 100 Hours. When tested in accordance with 4.7.4.5, calibration of the pressure gage shall be checked at 25, 50, 75 and 100 hours during the 100-hour endurance performance test. Calibration shall not be off by 10 percent or more of the indicated pressure. If calibration is off by 10 percent or more, the pressure gage shall be replaced and the previous 25 hours repeated. See 4.1.2.1.

3.10.3.7. Post-endurance Performance. When tested in accordance with 4.7.4.6, the post-endurance performance curve obtained after subjecting the pump to the 100-hour endurance test, shall not be below the pre-endurance maximum performance curve.

3.10.3.8. Pump Performance Rating. The pump performance rating shall be established as that condition at which the 100-hour endurance test is run (p_2f_2).

3.10.3.9. Pump Designation Code. After weighing the pump according to 3.4, completing inspection according to 4.5, and establishing pump performance rating according to 4.7, the pump unit shall be assigned a designation code indicating pump type, weight class, and performance rating.

- a. Design Type. Assign a letter "P" or "C" to indicate the design or type of pump: P for a positive displacement pump or C for a centrifugal pump.
- b. Weight Class Number. From the weight determined from 3.4, a weight class number shall be assigned using Table 2 below.

Table 2. Weight to Weight Class Conversion

Dry Weight		Weight Class Number
lb	kg	
0 to 45	0 to 20.6	045
46 to 80	20.7 to 36.5	080
81 to 130	36.6 to 59.2	130
131 to 175	59.3 to 79.6	175
176 to 200	79.7 to 90.9	200
201 to 300	91.0 to 136.3	300
301 to 400	136.4 to 181.6	400

c. Performance Rating Code Number. From the performance rating determined from 4.7 (p_2f_2), a pressure group number shall be assigned using Table 3 below (pressure, p_2); and a capacity group number shall be assigned using Table 4 below (flow, f_2).

Table 3. Pressure Performance Rating Code Number

Pressure Range		Pressure Group Number
psig	kPag	
150 to 199	1030 to 1374	15
200 to 249	1375 to 1719	20
250 or more	1720 or more	25

Table 4. Pumping Capacity Performance Rating Code Number

Pumping Capacity				Capacity Group Number
gpm		lpm		
9.0	to 10.9	34.1	to 41.4	09
11.0	to 14.9	41.5	to 56.6	11
15.0	to 19.9	56.7	to 75.5	15
20.0	to 24.9	75.6	to 94.4	20
25.0	to 29.9	94.5	to 113.3	25
30.0	to 34.9	113.4	to 132.3	30
35.0	to 39.9	132.4	to 151.2	35
40.0	to 49.9	151.3	to 189.0	40
50.0	to 59.9	189.1	to 226.9	50
60.0	to 69.9	227.0	to 264.7	60

d. Example. A centrifugal type pump weighing between 131 and 175 pounds (59.4 and 79.4 kg) and capable of operating continuously with a flow of 17 gpm at 200 psig (64.4 Lpm at 1379 kPag) discharge pressure, shall be designated as "C-175-20/15."

3.10.4. Sound Level.

3.10.4.1. Hearing Safety Label. A warning label shall be permanently attached to the equipment and clearly visible to the operator. The label shall indicate that hearing protection is required when within 13 ft (4 m) of the equipment.

3.10.4.2. Maximum Sound Level. When tested in accordance with 4.7.5, the average sound level shall not exceed 90 dBA at 13 ft or 4 m.

3.11. Metric Products. Metric dimensions are provided for information only, inch-pound units shall be the required units of measure for this specification. Thread series designations are indicated as 1 inch 11-1/2 NPSH, 1-1/2 inch 9 NH and 2-1/2 inch 7-1/2 NH. Since these are thread series designations, not an indication of a specific dimension, the metric equivalent is not given. Products manufactured to metric dimensions will be considered on an equal basis with those manufactured using inch-

4. SAMPLING, INSPECTION AND TEST PROCEDURES.

4.1. Qualification Testing.

4.1.1. Manufacturer Submission for Qualification Tests. The prospective contractor shall provide, without cost to the Government:

- a. Five complete sets or one reproducible set of detailed dimensional drawings and specifications.
- b. One sample pump unit with performance data and operating and maintenance instructions.
- c. Certificates of conformance. (See 4.6).
- d. The estimated test fee. Contact the Water Handling Project Leader at the USDA Forest Service, San Dimas Technology and Development Center (SDTDC), 444 East Bonita Avenue, San Dimas, CA 91773.
- e. A signed collection agreement. Contact the SDTDC Water Handling Project Leader for a copy of the form.
- f. All of the above items shall be delivered to SDTDC to the attention of the Water Handling Project Leader.

The Government shall not be responsible for the submitted test samples.

4.1.2. Qualification Test. Qualification inspection and tests shall be conducted by the Government and at the expense of the contractor at a fee to be determined by the Government. If requested by the contractor, the Government will inform the contractor of date and place of inspection and tests. The contractor may send a representative (who has been designated in writing) to be present and observe the inspection and tests, but they will not be permitted to be a participant. Upon completion of tests, the test sample will be retained by the Government. Qualification testing shall stop upon a single failure and the test sample rejected. The contractor will be informed as to the nature of the failure. The Government shall not be obligated to continue testing a defective item once it is known to be defective or when it is considered to be in the best interest of the Government.

4.1.2.1. Component Part Failure. If a component part fails during the test, it may be replaced by the manufacturer, but the sample must be run until the replacement part has completed 100 hours of operation. Replaced components failing twice will constitute disqualification of the pump.

4.1.3. Notice of Qualification. Notice of Qualification shall be issued to the contractor upon the successful completion of qualification tests. Copies of qualification notices shall be provided to the General Services Administration. A copy shall be retained in the SDTDC file.

4.1.4. Notice of Failure to Qualify. The contractor shall be notified by letter of a failure to qualify, if the submitted pump unit does not meet the requirements of this specification.

4.1.5. Re-qualification. After qualification, if any changes are made in the product or where it is manufactured, the contractor shall notify SDTDC immediately in writing. The need for requalification shall be determined by the Government when there are changes to the product or this specification.

4.2. General Inspection and Tests. Unless otherwise specified in the contract or purchase order, the contractor is responsible for performance of all inspection requirements prior to submission for Government acceptance inspection and tests. The contractor may utilize their own facilities or any commercial laboratory acceptable to the Government. Inspection records of the examination and tests shall be kept complete and available to the Government.

4.2.1. Inspection and Test Sites. The Government shall conduct lot acceptance inspection and tests to determine compliance with the specification. If lot acceptance and tests are conducted at locations other than the manufacturing facilities, the contracting officer will specify location and arrangements. In the case of on-site inspections at the contractor's facility, the contractor shall furnish the inspector all reasonable facilities for their work. During any inspection, the inspector may take from the lot one or more samples and submit them to an independent test laboratory approved by the Government or to a Government test facility for inspection and tests.

4.2.2. Testing With Referenced Documents. The contractor is responsible for ensuring that components and materials used were manufactured, examined and tested in accordance with referenced specifications and standards. The Government reserves the right to perform any of the inspections or tests set forth in this section where such action is deemed necessary to assure supplies and services conform to prescribed requirements. All inspection or testing of a sample shall stop upon a single failure and the sample rejected. The contractor will be informed as to the nature of the failure. The Government shall not be obligated to continue testing a defective item once it is known to be defective or when it is considered to be in the best interest of the Government.

4.3. Responsibility for Compliance. All items shall meet all requirements of sections 3 and 4. The inspection set forth in this specification shall become a part of the contractor's overall inspection system or quality program. The absence of any inspection requirements in this specification shall not relieve the contractor of the responsibility of ensuring that all products or supplies submitted to the Government for acceptance comply with all requirements of the contract. Sampling inspection, as part of manufacturing operations, is an acceptable practice to ascertain conformance to requirements, however, this does not authorize submission of known defective material, either indicated or actual, nor does it commit the Government to accept defective material.

4.4. Sampling for Inspection. When inspection is performed, sampling shall be in accordance with ANSI/ASQC Z 1.4.

4.4.1. Lot. All pump units of the same type, presented together in one delivery shall be considered a lot for the purpose of inspection. A sample unit shall be one pump unit.

4.4.2. Sampling for Visual and Dimensional Examination. Sampling for visual and dimensional examination shall be S-2, with an Acceptable Quality Level (AQL) of 1.0 percent defective.

4.4.3. Sampling for Lot Acceptance Tests. Sampling for lot acceptance testing shall be S-2 with an AQL of 1.0 percent defective.

4.5. Inspection and Tests.

4.5.1. Visual and Dimensional Examination. When selected in accordance with 4.4.2, each sample pump unit shall be visually and dimensionally examined to determine conformance with this specification. Visual or dimensional defects shall be classified as major or minor. A defect not listed in Table 5 shall be classified as a minor defect. If the number of defects in any sample exceeds the indicated AQL, the lot shall be rejected.

Table 5. Major and Minor Defects

Defect	Classification	
	Major	Minor
1. Engine and components not as required.	X	
2. Pump and components not as required.	X	
3. Frame and carrying handle not as required.	X	
4. Accessories not as required.	X	
5. Welding not as required.	X	
6. Threads, waterways, gaskets and markings not as required.	X	
7. Materials not as required.	X	
8. Workmanship not as required.	X	
9. Painting and color not as required.		X

4.5.2. Lot Acceptance Tests. Each of the samples selected in accordance with 4.4.3, shall be tested in accordance with 4.7, to determine conformance with requirements of this specification.

4.5.3. Quality Conformance Inspection. Unless otherwise specified, sampling for inspection shall be performed in accordance with ANSI/ASQC Z 1.4. The inspection level and AQL shall be as specified in 4.4.3.

4.6. Certificate of Conformance. A Certificate of Conformance shall meet the requirements of USDA Forest Service Standard 5100-190. Where certificates of conformance are required, the Government reserves the right to verify test any such items to determine the validity of certification. These certificates shall be based on the testing of component materials and may be performed by the component material supplier. The contractor shall provide certificates of conformance for 3.3, 3.7 and 3.10.4 (see 4.6.2, 4.6.3 and 4.6.4).

4.6.1. Certificates of Conformance in Lieu of Testing. Unless otherwise specified, certificates of conformance may be acceptable in lieu of testing end items.

4.6.2. Pump Material. In accordance with 3.3, the pump shall meet the indicated material physical property requirements.

4.6.3. Surface Treatment. In accordance with 3.7, aluminum alloy threaded surfaces shall meet the indicated requirements, when tested to the defined test methods.

4.6.4. Sound Level. In accordance with 3.10.4, pump unit sound levels shall meet the indicated requirements, when tested to the defined test methods.

4.7. Performance Testing. Samples shall be subjected to the following tests to determine if the samples meet the requirements of the specification.

4.7.1. Fluid Medium. All testing requiring the use of a fluid medium shall be performed using municipally supplied potable water; this shall include, but is not limited to pump performance testing. If the contractor does not have access to a municipal water supply, the testing shall be performed using any clear fresh water normally available for firefighting. Testing performed by the Government will be conducted using municipally supplied potable water.

4.7.2. Pump Setup. The pump unit shall be installed on a pump test stand with necessary controls to conduct pump performance tests below. If the pump unit has not been previously broken-in by the contractor, it shall be subjected to a break-in period of at least 4 hours of varying speeds and loads.

4.7.2.1. Pressure Gage Calibration at 0 Hours. As required by 3.10.1, the pressure gage shall be calibrated.

4.7.2.2. Priming Test. As required by 3.10.3.2, the priming capabilities of the pump shall be determined. The pump unit shall be started with a vacuum of 17 inches Hg (58 kPa) through a 1-inch 11-1/2 NPSH, 1-1/2 inch 9 NH or 2-1/2 inch 7-1/2 NH suction hose and discharged through a 1-1/2 inch 9 NH hose. The amount of time required to establish prime shall be recorded. The priming system shall be capable of priming and pumping water at a 17 foot (5.1 m) lift.

4.7.2.3. Drafting Test. As required by 3.10.3.3, drafting capabilities shall be determined. After prime has been established, drafting shall be continued at 17 inches Hg (58 kPa) vacuum, while observing pump flow and pressure.

4.7.3. Engine Testing.

4.7.3.1. Over-speed Control Test. As required by 3.10.2.1, the pump's over-speed control capability shall be tested. With the pump unit running at the manufacturer's recommended speed, priming shall be interrupted by breaking the pump inlet vacuum, thereby inducing engine speed increase. The engine speed shall be observed for over-speed.

4.7.3.2. Governor Test. As required by 3.10.2.2, the governor speed range shall be determined. The pump shall be run at full throttle at the manufacturer's rated performance pressure. Then the throttle shall be reduced while maintaining pressure at rated performance until the flow is reduced to a minimum. The difference between full and minimum throttle shall be established as the governor speed range.

4.7.4. Pump Testing.

4.7.4.1. Suction Lift Test Condition. All pump testing shall be conducted at a 10 foot (3.0 m) \pm 3 inch (76 mm) suction lift.

4.7.4.2. Pressure Relief Test. As required by 3.10.3.1, the pressure relief valve or regulator on positive displacement pump units shall be tested. With the pressure relief control set in accordance with the manufacturer's recommendations, and the pump unit running at rated performance, the pump discharge shall be closed gradually until the bypass through the relief valve or regulator reaches full flow. The pump discharge pressure shall be observed.

4.7.4.3. Pre-endurance Maximum Performance Test. As required by 3.10.3.4, the pump unit shall be tested for pre-endurance maximum performance. The pump shall be run at the maximum speed recommended by the manufacturer. The pump discharge shall be reduced in 25 psig (172 kPag) increments until complete shutoff. Pressure, flow and speed shall be recorded at each 25 psig (172 kPag) increment. From this information, the maximum performance curve shall be plotted on a graph. The maximum performance curve shall be corrected to standard sea level conditions at 29.92 inches Hg (102 kPa) vacuum and 60 °F (15.5 °C) in accordance with SAE J 1349. See Figure 1. The maximum pump power shall be the highest value obtainable by multiplying pressure (p_1) and flow rate (f_1) on the corrected curve.

4.7.4.4. 100-Hour Endurance Performance Test. As required by 3.10.3.5, the pump shall be tested for 100 hours endurance performance. The endurance testing does not need to be continuous, but each segment of the total 100 hours shall be a minimum of seven hours of continuous operation. After plotting the corrected curve and determining the maximum pump power, $p_1 f_1$, the endurance performance curve shall be plotted by using 85 percent of the corrected curve. For example, multiply $\sqrt{0.85}$ with each value of the corrected curve ($p_2 = p_1 \times \sqrt{0.85}$, $f_2 = f_1 \times \sqrt{0.85}$). After plotting the endurance performance curve, draw a straight line between $p_1 f_1$ and the zero point on the graph. See Figure 1. The intersection of the straight line with the endurance performance curve shall be indicated as the pump performance rating, $p_2 f_2$, on the graph which shall be the pressure and flow rate values used in conducting the 100-hour endurance test.

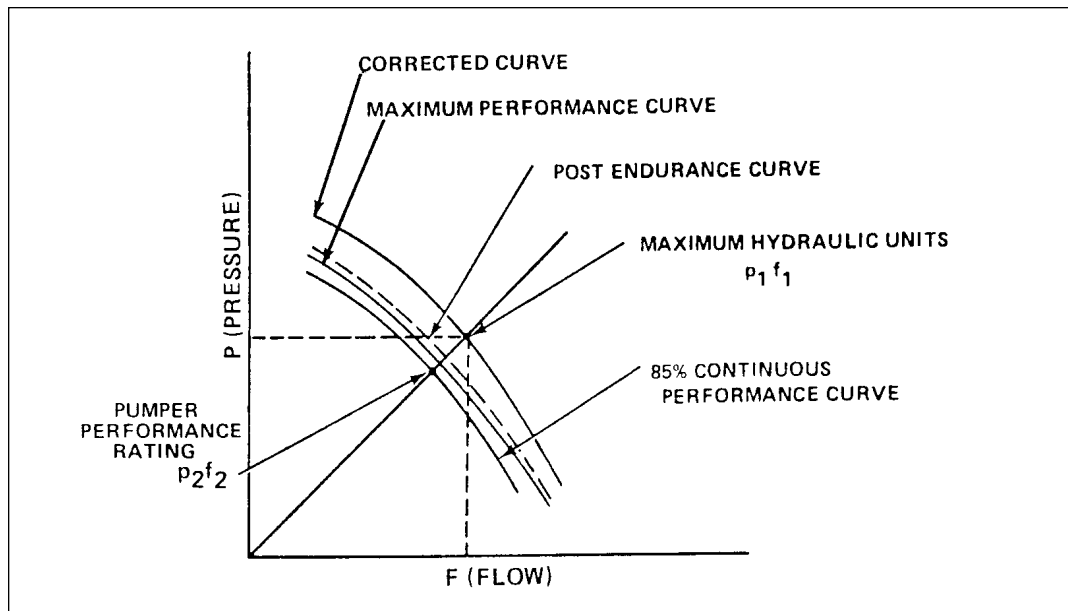


Figure 1. Pump performance curve.

4.7.4.5. Pressure Gage Calibration at 25, 50, 75 and 100 Hours. As required by 3.10.3.6, the pressure gage shall be calibrated at 25, 50, 75 and 100 hours during the 100-Hour Endurance Performance Test. If calibration is off by 10 percent or more, the pressure gage shall be replaced and the previous 25 hours repeated. See 4.1.2.1.

4.7.4.6. Post-endurance Performance Test. As required by 3.10.3.7, the pump unit shall be tested for post-endurance performance. The pump unit shall be run at maximum speed and the pump discharge reduced by 25 psig (172 kPag) increments until complete shutoff. The pressure and flow values shall be corrected to standard sea level conditions and plotted on the graph then compared with the pre-endurance curve.

4.7.5. Sound Level Test. As required by 3.10.4, the pump unit shall be tested for sound level.

4.7.5.1. Test Site. The test site shall consist of a flat, smooth, outdoor area. The surface shall be covered with grass or turf not higher than 3.0 inches (76.2 mm), pavement, bare earth, gravel, or a similar substance. In addition, the surface shall be free of snow, loose dry grass or weeds, ashes, or other substances which might interfere with the accuracy of the test. There shall be no obstructions larger than the size of a person within 50.0 ft (15.2 m) and no obstructions at all within 13.0 ft (4.0 m) of the pump unit under test.

4.7.5.2. Test Instruments. A sound level meter meeting the requirements of ANSI Standard S 1.4-1983, Type 1 or 2 shall be used. The A-weighted scale shall be used during the measurements with the sound level meter set to slow response.

4.7.5.3. Test Method. The pump unit shall be operated at $p_2 f_2$. Measurements shall be taken at four equally dispersed points around the pump unit with the sound level meter microphone located at a horizontal distance of 13.0 ft (4.0 m) from the pump unit and 5 ft (1.5 m) above the ground. The sound level meter manufacturer's instructions shall be followed for proper orientation of the microphone. Note: A free field response microphone is generally pointed towards the sound source, and a pressure response microphone is generally oriented perpendicular to a line between the sound source and the microphone.

4.7.5.4. Limit and Report. The average of the four sound level measurements shall be reported to the nearest whole decibel.

5. PACKAGING, PACKING AND MARKING.

5.1. Packaging, Packing and Marking. The packaging, packing and marking shall be as specified in the contract or order.

6. NOTES.

6.1. Intended Use. The engine-driven pumps described in this specification are designed for use in wildland firefighting operations. The pumps consist of a gasoline-driven engine, a positive displacement or centrifugal type pump, mounting frame, engine controls, spark arrester and other components.

6.2. Acquisition Requirements. Acquisition documents, such as Invitation For Bids and Request For Proposals should specify the following:

- a. Title, number and date of this specification.
- b. Designation code of pump required (See 3.10.3.9).
- c. Color of pump required, red or green. (See 3.3.1).
- d. If certificates of conformance are acceptable in lieu of lot by lot testing (See 4.6).
- e. Packaging, packing and marking (See 5.1).
- f. Date of the invitation for bids or request for proposals (See 2.1).

6.3. Qualification. The contracting officer should verify that the bidder possesses a currently valid notice of qualification with associated Qualified Products List (QPL) number obtained in accordance with 4.1. This QPL shall have already been obtained with a date of issue prior to the date of invitation for bids.

6.4. Notice. When Government drawings, documents, or other data are used for any purpose other than in connection with a definitely related Government procurement operation, the United States Government thereby incurs no responsibility nor any obligation whatsoever.

6.5. Preparing Activity. USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, CA 91773-3198.

**United States Department of Agriculture, Forest Service
Standardization Document Improvement Proposal**

Instructions: This form is provided to solicit beneficial comments which may improve this document and enhance its use. Contractors, government activities, manufacturers, vendors, or other prospective users of this document are invited to submit comments to the USDA Forest Service, San Dimas Technology and Development Center, 444 East Bonita Avenue, San Dimas, California 91773-3198. Attach any pertinent data which may be used in improving this document. If there is additional documentation, attach it to the form and place both in an envelope addressed to the preparing activity. A response will be provided when a name and address are included.

Note: This form shall not be used to submit request for waivers, deviation, or for clarification of requirements on current contracts. Comments submitted on this form do not constitute or imply authorization to waive any portion of the referenced document(s) or to amend contractual requirements.

Standard Number and Title: **Specification 5100-273d, Pump, Engine Driven**

Name of Organization and Address:

Vendor

User

Manufacturer

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San Dimas Technology & Development Center
ATTN: Water Handling Project Leader
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